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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte KWANG-JO HWANG*

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Appeal 2008-0126  
Application 09/648,111  
Technology Center 2800

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Decided: May 30, 2008

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Before KENNETH W. HAIRSTON, MAHSHID D. SAADAT, and  
ROBERT E. NAPPI, *Administrative Patent Judges*.

NAPPI, *Administrative Patent Judge*.

**DECISION ON APPEAL**

This is a decision on appeal under 35 U.S.C. § 6(b) of the final rejection of claims 1 through 11, and 13 through 31.

We affirm the Examiner's rejection of these claims.

**INVENTION**

The invention is directed to a method of patterning a metal layer in a semiconductor device. See page 3 of Appellant's Specification. Claim 1 is representative of the invention and reproduced below:

1. A method of manufacturing a liquid crystal display device, comprising:

forming a switching element on a substrate;  
forming a passivation layer over the substrate;  
depositing a metal layer on the passivation layer;  
forming a photoresist pattern on a surface of the metal layer,  
such that an upper portion of said metal layer is exposed;  
treating the exposed portion of said metal layer with a first  
plasma, prior to any step of etching said photoresist pattern, and prior  
to any step of etching said metal layer, thereby lowering an internal  
binding force in the exposed portion of said metal layer to increase a  
subsequent etch rate of said metal layer; and  
etching the treated portion of said metal layer to form a pixel  
electrode, wherein said depositing a metal layer on the passivation  
layer, forming a photoresist pattern, and treating the exposed portion  
of said metal layer are sequentially performed.

#### REFERENCES

Hirano	US 5,771,110	Jun. 23, 1998
Ye	US 5,968,847	Oct. 19, 1999
Chen	US 6,133,145	Oct 17, 2000 (filed Oct. 9, 1998)
Muraguchi	JP 61-002368 A	Jan. 8, 1986

#### REJECTIONS AT ISSUE

Claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28  
through 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable  
over Hirano in view of Chen. The Examiner's rejection is on pages 3  
through 11 of the Answer.

Claims 10, 17 through 19, and 25 through 27 stand rejected under 35  
U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Ye.  
The Examiner's rejection is on pages 11 through 13 of the Answer.

Claims 3, 4, 14, and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Muraguchi. The Examiner's rejection is on page 13 of the Answer.

Throughout the opinion, we make reference to the Brief (received September 15, 2006), Reply Brief (received February 5, 2007) and the Answer (mailed December 4, 2006) for the respective details thereof.

## ISSUES

### *Rejection under 35 U.S.C. § 103(a) over Hirano in view of Chen.*

Appellant argues on pages 8 through 17 of the Brief that the Examiner's rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) is in error. Appellant argues, that “[n]one of the applied prior art teaches or suggests reducing the binding force in the metal layer so as to enhance the etch rate.” App. Br. 12. Appellant states that Hirano teaches a method of manufacturing a liquid crystal display that includes a step of etching a portion of a metal layer, but there is no discussion of reducing the binding force of the metal layer. App. Br. 12. Appellant states that Hirano does not teach reducing the binding force of the metal layer, but rather a plasma treating process using nitrogen which makes a photoresist shape more resistant to an etch cycle. App. Br. 13-14. As such Appellant reasons that Chen teaches away from the claimed objective of reducing binding force of the material. App. Br. 14. Further, Appellant argues that, as Chen is concerned with modifying the photoresist, adapting Chen to modify the metal layer impermissibly changes the principle of operation in Chen. App. Br. 15. Appellant also argues, on

pages 18 and 19 of the Brief that figure 7 of the Specification demonstrates unexpected results from using the invention.

In response the Examiner states in the Answer:

In the plasma treatment step of Chen, the entire structure is exposed to the nitrogen plasma. That is the photoresist pattern 12b as well as the metal layer 10a are exposed to the plasma treatment. See Chen figure 5. In combining the plasma treatment step of Chen into the process of Hirano, the plasma treatment is performed on the photoresist and exposed portion of Hirano's IT0 16 (Indium Tin Oxide, metal layer). This plasma treatment performed on the exposed surface of the metal layer is the same plasma treatment as appellant's invention.

In performing the plasma treatment step of Chen on the photoresist pattern and exposed metal layer of Hirano, the lowering of an internal binding force in the exposed portion of the metal layer would take place as the plasma treatment step in Chen is the identical plasma treatment step of the instant invention. Therefore, the combination reads on and teaches all the limitations of the claims.

Ans. 15-16. In response to Appellant's asserted unexpected results, the Examiner states that the evidence is not persuasive and does not compare the Appellant's invention to the art applied in the rejection. Ans. 22. The Examiner also states that the evidence does not identify which of the plasma procedures is used and that the evidence is not commensurate with the scope of the claims. Ans. 23. Further, the Examiner states that the evidence is not persuasive as "applicant has merely recited an additional advantage that is already present in and would naturally flow from the suggestion of the prior art." Ans. 24.

Appellant, on page 5 of the Reply Brief, states that the Examiner's reasoning relies upon inherency to establish that Chen teaches reduction of the internal binding force. Appellant argues that the Examiner has not "provided extrinsic evidence demonstrating that the reduction in binding

force would necessarily result from the combination of Hirano and Chen.”

Reply Br. 6.

Thus, Appellant’s contentions present us with two issues. First whether Appellant has demonstrated that the Examiner erred in determining that the combination of Chen and Hirano teaches treating an exposed portion of a metal layer with a first plasma, prior to any step of etching said metal layer, thereby lowering an internal binding force in the exposed portion of said metal layer to increase a subsequent etch rate of said metal layer as claimed. Second, whether Appellant has presented sufficient evidence to demonstrate unexpected results which would overcome a determination of obviousness.

*Rejection under 35 U.S.C. § 103(a) over Hirano, Chen and Ye.*

Appellant argues on page 17 of the Brief that the Examiner’s rejection of claims 10, 17 through 19, and 25 through 27 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Ye is in error.

Appellant argues that Ye fails to “address the deficiencies of Hirano and Chen in suggesting a claimed embodiment.” App. Br. 17.

Thus, Appellant’s contentions present us with the same issues as discussed with respect to the Examiner’s rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen.

*Rejection under 35 U.S.C. § 103(a) over Hirano, Chen and Muraguchi.*

Appellant argues on page 18 of the Brief that the Examiner's rejection of claims 3, 4, 14, and 23 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Muraguchi is in error. Appellant argues that Muraguchi fails to "address the deficiencies of Hirano and Chen in suggesting a claimed embodiment." App. Br. 18.

Thus, Appellant's contentions present us with the same issues as discussed with respect to the Examiner's rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen.

#### FINDINGS OF FACT

1. Appellant's Specification states that the exposed metal layer is exposed to a plasma of reactive gas such as H<sub>2</sub> or a non-reactive gas such as Ar or N<sub>2</sub>. When the H<sub>2</sub> is used the gas reacts with the metal layer to form H<sub>2</sub>O and the binding force of the remaining metal is lower. When a non-reactive gas is used "the binding force of the surface of the metal layer 44 becomes depressed physically. In particular Ar or N<sub>2</sub> ions physically strike the surface of the metal layer 44, thereby breaking the chemical bonds and lowering the overall binding force of the metal layer." Specification 6-7.
2. Hirano teaches a method of fabricating a thin film transistor device for a liquid crystal display. Abstract, col. 2, ll. 42-46.

3. Chen teaches a method to increase the etch ratio between metal and photoresist by use of a plasma treatment. Abstract.
4. A photoresist shape is applied over a metal layer. Chen, col. 4, ll. 1-10.
5. A plasma treatment, using nitrogen, is applied to the photoresist shape (item 12b) as shown in figure 6. Chen, col. 4, ll. 16-24.
6. This plasma treatment can be applied after an initial etch or before any etch treatments. Chen, col. 4, ll. 52-55.
7. The plasma treatment makes the photoresist more resistant to etching and increases the etch ratio between the metal and photoresist. Chen col. 4, ll.18-20, 36-43.
8. As is apparent from figure 6, the aluminum based metal layer (item 10a) or the titanium nitride layer (item 11a), depending upon whether the plasma is applied before or after the initial etch, is also exposed to the nitrogen plasma. However, Chen does not discuss the effects of the plasma treatment on either of these metals.

#### PRINCIPLES OF LAW

Our reviewing court has said “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied upon.” *In re Schreiber* 128 F.3d 1473,

1478 (Fed. Cir. 1997) (citing *In re Swinehart* 439 F.2d 210, 213 CCPA 1971)). Thus, the burden shifts to the Appellant to disprove inherency. *Id.*

## ANALYSIS

### *Rejection under 35 U.S.C. § 103(a) over Hirano and Chen.*

Appellant's arguments on pages 8 through 17 of the Brief are directed to claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 as a group. Thus, in accordance with 37 C.F.R. § 41.37 (c)(1)(vii) we group claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 together and select claim 1 as representative of the group.

Appellant has not persuaded us that the Examiner erred in determining that the combination of Chen and Hirano teaches treating an exposed portion of a metal layer with a first plasma, prior to any step of etching said metal layer, thereby lowering an internal binding force in the exposed portion of said metal layer to increase a subsequent etch rate of said metal layer as claimed.

Claim 1 recites that a plasma gas is applied to the metal layer and that this plasma gas lowers the internal binding force of the exposed metal layer. Appellant's Specification identifies that one of the plasma gases that performs this function is N<sub>2</sub>, and that the process of lowering the internal binding force is created by the plasma breaking the chemical bonds in the metal layer. Fact 1. The Examiner has found that Chen teaches the same process of applying a plasma. Ans.17-18. We concur with the Examiner, and find that Chen teaches applying a plasma treatment of N<sub>2</sub> to a photoresist shape applied over a metal layer. Fact 5. This plasma treatment

is also applied to the metal layer surrounding the photoresist layer. Fact 8. While Chen teaches that the plasma makes the photo resist more resistant to etching, but remains silent on lowering the binding force, we consider there to be ample evidence of record to believe that the plasma process of Chen and Appellant's to be the same. As such, we consider the Examiner to have reason to believe that the functional limitation of lowering the binding force of the metal layer to be an inherent characteristic of Chen's process. As such the burden is on Appellant to disprove inherency. *See Schreiber, Id.*

Appellant's argument that Chen teaches away from the claimed objective of reducing binding force of the material is not persuasive. The stated purpose of Chen is to reduce the etch ratio between the metal layer and the photoresist. Facts 3 and 7. Increasing the photoresist's resistance to etching and reducing the binding force of the metal layer, to make the metal more susceptible to etching, are additional benefits and will both achieve the result of reducing the ratio. Thus, we do not find that Chen teaches away from the claimed invention. Rather, the evidence suggests that the plasma inherently lowers the binding ratio. It appears that Chen achieved the result of increasing the etch ratio by both increasing the photoresist's and decreasing the metal's resistance to the etch cycle. Accordingly, we do not find that the Examiner erred in determining that the combination of Chen and Hirano teaches treating the exposed portion of a metal layer with a first plasma, prior to any step of etching said metal layer, thereby lowering an internal binding force in the exposed portion of said metal layer to increase a subsequent etch rate of said metal layer as claimed.

Appellant's arguments have not demonstrated unexpected results which would overcome a determination of obviousness. Appellant relies

upon the graph in figure 7 of the Specification as evidence of unexpected results. As the Examiner identifies, this graph shows results of using the Appellant's method as compared with results using the "conventional art." Appellant has not shown that the "conventional art" method depicted in figure 7, is the plasma treatment discussed in Chen. Rather, as is apparent from page 2 of Appellant's Specification, the conventional art involves no plasma treatment. Thus, we do not consider Appellant to have provided sufficient evidence of unexpected results to overcome the Examiner's finding of obviousness.

Accordingly, Appellant's arguments have not persuaded us of error in the Examiner's rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen.

*Rejection under 35 U.S.C. § 103(a) over Hirano, Chen and Ye.*

As identified above, Appellant's contentions with respect to this rejection present us with the same issues as discussed with respect to the Examiner's rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen. As discussed *supra*, we are not persuaded of error in the Examiner's rejection 35 U.S.C. § 103(a) of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31.

Accordingly, Appellant's arguments have not persuaded us of error in the Examiner's rejection of claims 3, 4, 14, and 23 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Muraguchi.

*Rejection under 35 U.S.C. § 103(a) over Hirano, Chen and Muraguchi.*

As identified above, Appellant's contentions with respect to this rejection present us with the same issues as discussed with respect to the Examiner's rejection of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen. As discussed *supra*, we are not persuaded of error in the Examiner's rejection 35 U.S.C. § 103(a) of claims 1, 2, 5 through 9, 11, 13, 15, 16, 20 through 22, 24, and 28 through 31. Accordingly, Appellant's arguments have not persuaded us of error in the Examiner's rejection of claims 10, 17 through 19, and 25 through 27 under 35 U.S.C. § 103(a) as being unpatentable over Hirano in view of Chen and Ye.

## CONCLUSION

We affirm the Examiner's rejections of claims 1 through 11, and 13 through 31.

## ORDER

The decision of the Examiner is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

Appeal 2008-0126  
Application 09/648,111

AFFIRMED

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